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ABSTRACT

This study of the Apple Classroom of Tomorrow (ACOT) environment focused on the potential of a computer-saturated environment to facilitate students' thinking processes. Four approaches were used: (1) a longtitudinal approach to study student growth and development; (2) observations of students' behavior while writing with the computer to study their thinking processes; (3) daily interviews with students to explore the nature of their thinking while writing; and (4) lengthy generalized interviews to determine students' use of the computer in the home and school environment. ACOT students in the ninth and tenth grades were found to be both confident and positive about their computer experiences. Students found the computerized learning to be more challenging, with Hypercard, computer-based robotics, and computer graphics affording a more dynamic learning experience. The graphic feature available with the Macintosh appeared to be a vital feature of the students' writing and the nature of engaged thinking strategies. Students also demonstrated an expanding repertoire of planning and revision behavior, and several students commented that using computer-generated text allowed them to make more revisions and check for coherence. Finally, ACOT students who had returned to regular classroom environments had maintained the computer-based skills they had acquired, although they were disappointed at the lack of computer opportunities in the regular classroom environment. The text is supplemented by two diagrams and numerous charts. (EW)

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The Engagement of Thinking Processes: A Two Year Study of Selected Apple Classroom of Tomorrow Students ©

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The Engagement of Thinking Processes: A Two Year Study of Selected Apple Classroom of Tomorrow Students

The Engagement of Thinking Processes:

A Two Year Study of Selected

Apple Classroom of Tomorrow Students

The present investigation represents a continuation and expansion of the first year's exploration of the potentials for the enhancement of thinking skills in a computer saturated learning environment. The basic questions driving the study remain: What potential does the ACOT classroom have to engage and enhance thought processes? What is the role of the computer in achieving these potentials? What are some of the other factors which contribute to these potentials? To these ends the investigation pursued four studies:

1. an examination of the thought processes of the students who had spent two years in the computer-saturated environment and a comparison of their comments with data from the preliminary study conducted in year one.

2. an examination of selected ninth grade students at the beginning and end of their first year in the ACOT environment.

3. an examination of the impact of the computer-saturated environment upon students who had left ACOT and were attending 'regular' classrooms.

4. an exploration of the possible influences of multi-media, multi-layered electronic text upon thought processes, especially perspective-taking, driving reading and writing.

Some of the features of these studies were as follows:

- The current examination of the thought processes associated with computer-based writing experiences is one of the few

longitudinal studies which have been pursued. Longitudinal studies exploring the use of computers across extended periods of time are rare; most studies have tended to be "single-shot" analyses of student behavior involving, at best, examinations of effects across hours, days, or weeks.

- The site for the collection of data afforded an examination of potentials within a computer-saturated environment—a context within which students have extended access (both at home and at school) to "state of the art" software and hardware. Other studies have afforded students a fraction of the access achieved in the ACOT environment including "a level of investment" problem to consider potential outcomes.

- The diversity of the subject pool enabled the inclusion of students varying in ability, background, tenure in ACOT and affiliation.

- The "state of the art" software—especially the multi-media, multi-layered text possibilities afforded by Hypercard—as well as desktop publishing options that the Macintosh offers, allowed for an examination of possibilities which extended beyond previous considerations of school-based computer use.

METHOD

Overview

This study, longitudinal in focus, extends last year's investigation and examines the potential of a computer-saturated environment to facilitate students' thinking processes. Specifically, we are investigating the relationship between the computer, writing, thought, and learning. The longitudinal approach allows the researcher to collect data across time, sensitizing us to student growth and development.

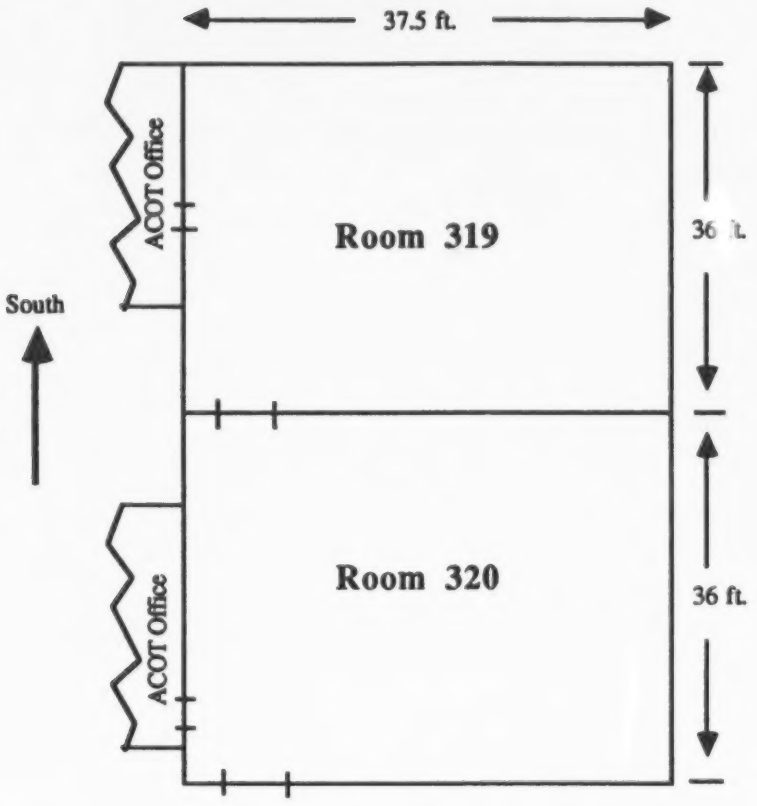
Our approach is fourfold. First, to sensitize us to student growth and development, we have adopted a longitudinal approach involving the equivalent of repeated measures across time. Second, we investigated thinking processes by observing student behavior while writing with the computer. Third, in order to probe the nature of the thinking students engaged in while they were writing, we conducted daily interviews about these activities. Fourth, to obtain a comprehensive perspective on student's use of the computer in the home and school environment we conducted lengthy generalized interviews. These data, in the form of videotaped observations, observational record sheets, and extensive, retrospective interviews are then logged, transcribed, coded, and analyzed.

We spent extensive time with participants, observing and interviewing the ninth graders four times for two week sessions each. We followed up the tenth graders in a two week session. In addition, we interviewed ACOT students who had returned to the regular classroom.

A glimpse of the classroom...

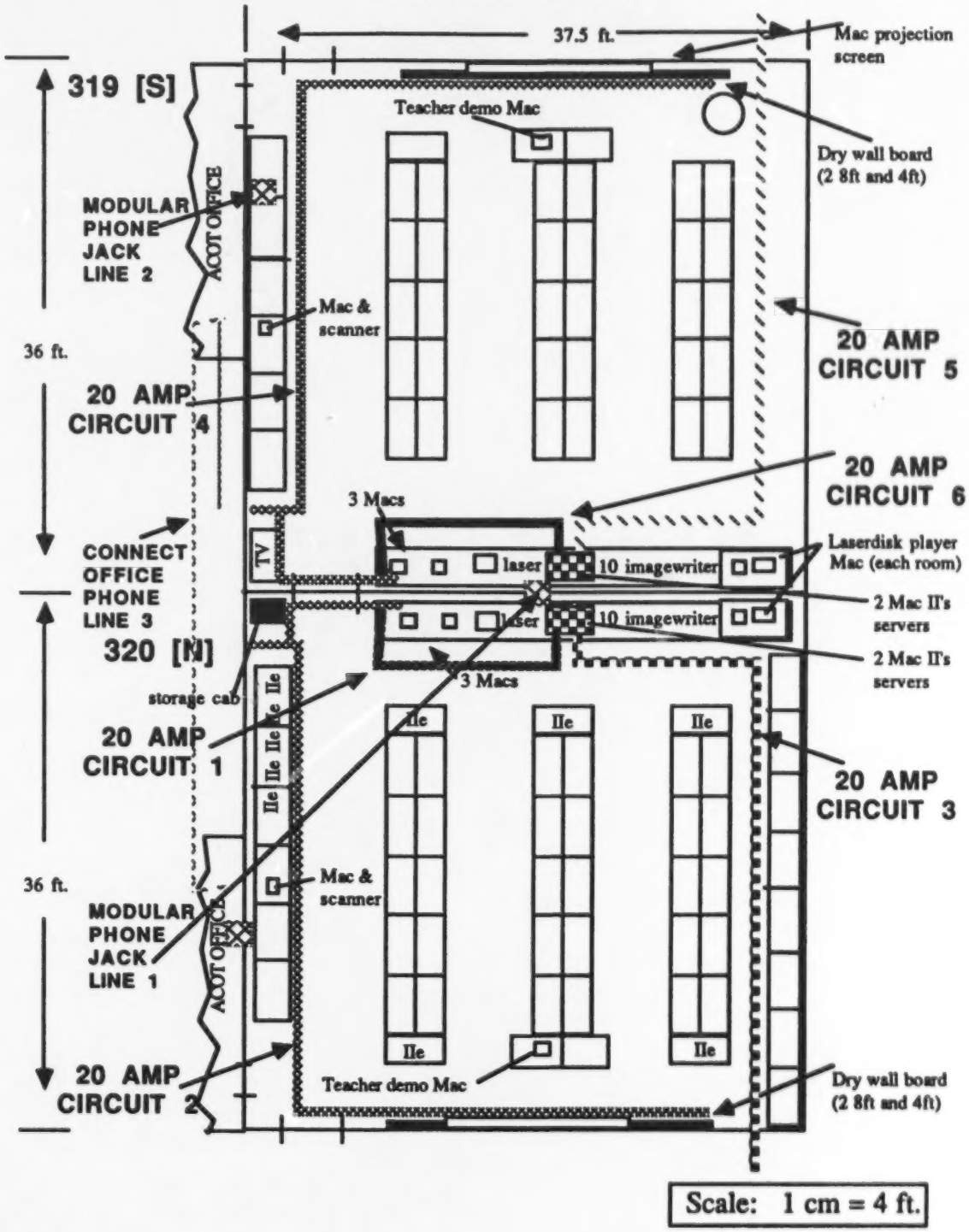
The Apple Classroom of Tomorrow in Columbus was a large room with high ceilings with a westerly wall of windows on the third floor of a large city high school. The classroom housed thirty (30) students arranged in rows of desks, each with a computer. Two to four teachers were usually present along with the coordinator, selected observers/researchers and visitors. On the walls around the room were displays of classroom products and a large wall chart which included photographs and biographical information on the teachers and students. Around the perimeter of the room were other terminals, including Apple IIe machines, and printers.

West High School
Apple Classroom of Tomorrow
1987-88



West High Apple Classroom of Tomorrow

Rooms 319 and 320



The classroom included a mix of teacher-directed learning as well as independent and collaborative computer-based problem-solving. The computer served as a major resource and tool—it seemed to be well integrated into classroom use. Typically, the classroom was alive with students working on their computers, interacting with one another over the computers, teachers guiding selected students, researchers interviewing students or trying to observe inconspicuously from the sides of the room. During study hall and free time, the same level of activity persisted as students continued to work at their computers, chat informally or help each other out with problems.

Specific features of ACOT...

- The Apple Classroom of Tomorrow in Columbus were self-contained ninth and tenth grade classrooms in a large inner city high school that draws students from working class homes of mixed racial origins.

- Five teachers (science, algebra, social studies, English) staffed the classroom and worked together as a team to provide integrated learning experiences.

- In accordance with the school's morning timetable, there was a home room and five 40 minute periods (algebra, science, social studies, English, study hall). The ACOT teachers would often co-teach and vary the timetable to allow for certain topics to be more fully developed or to allow interrelation between subject areas. In the afternoon, students pursued individual courses of study outside ACOT.

- The physical arrangement of the self-contained classroom environment provided each student with an individual workspace with a desk, a computer, external disk drive, disk file, and an area for books.

- Each student had the use of a Macintosh computer, both at home and at school, courtesy of the Apple Corporation. Each of the staff members had the use of a Macintosh at home. Both students and teachers have access to a range of software. The figure below lists the various software to which students are introduced. Both students and teachers are networked on MacJanet.

SOFTWARE NAME	COMPANY	PURPOSE
Access II IIe	Apple	communications
Algebra I & II	True Basic	algebra
Apleworks IIe	Apple	communications transfer of data application
Balance of Power	Mindscape	world social issues - government
BASIC	Microsoft	programming
Biosci	Video Discovery	interactive video biology stacks
Calendar Maker	C E Software	class events organization
Colormate	Softstyle Inc.	color printing
ColorPrint	I/O Design Inc.	color printing
Comic Works	Mindscape	art
Cricket Draw	Cricket	art, drawing, graphs
Cricket Graph	Cricket	art, drawing, graphs
Easy 3D	Enabling Technologies	art drawing, graphs
Excel	Microsoft	Spreadsheet and graphs
File	Microsoft	database
Fischer Technic	Fischer Technic	electronic erector set
Forbidden Castle	Mindscape	reading and problem solving
FullPaint	Ann Arbor Softworks	art and drawing
Geometry	Brøderbund	math - geometry
Hypercard	Apple	database and more
LaserCard	Optical Data	interactive video biology stacks
MacChemistry	Fortnum	Science
MacDraw	Apple	art and drawing
MacJANET	Watcom	network software - file serve
MacPaint	Apple	art and drawing
MacTerminal	Apple	telecommunications
MacWrite	Apple	word processing
MasterType	Scarborough	keyboarding
PageMaker	Aldus	desktop publishing
Pascal	Apple	programming
perceptronics	Perceptronics	electronic erector set - Mac interface
Publish Pac	DEST	utility for DEST scanner
Quart Xpress	Quark	desktop publishing
Science Tool Kit IIe	Brøderbund	science lab Apple IIe
SuperPaint	Silicon Beach Software	art and drawing
Tempo	Affinity	macro maker
The Mist	Mindscape	reading and problem solving
Toyshop	Brøderbund	art and model construction
Typing Tutor III	Kriya Systems	keyboarding
VideoWorks	MacroMind Inc.	art and drawing
Voodoo Island	Mindscape	reading and problem solving
Word	Microsoft	word processing
Works	Microsoft	integrated (WP, DB, SS & graphics, telecommunications)

- Over ten printers, including a laser printer, additional Macintosh, and some Apple IIe computers were located strategically throughout each room. In addition, there exists a scanner and laser disk player in the rooms.

- For instructional purposes, there existed an overhead projector capable of reproducing a Macintosh screen as a six-foot screen. In addition, teachers had access to a wide range of other resources (16 mm projectors, video equipment) located in the school.

Nature of observations...

Over the course of two sessions, the behaviors of five ninth grade ACOT students were observed during writing and writing-related activities stemming from selected topics in life studies. Minute by minute running records of teacher and class activity were obtained simultaneously as the behaviors of the five students were recorded. In turn, these running records were used as a basis for developing individual student interviews.

Series of lessons and nature of the running records...

As these lessons proceeded, two sets of records of classroom activities were made: 1) videotapes were made of the classroom activities and 2) observers kept running records of the teachers and the class's activities as they noted (minute by minute) the behavior of the five ninth grade ACOT students (Mum, Tim, Jason, Doug, Rachael) and four tenth grade students (Mark, David, Lisa, Toya). One observer was assigned to observe Jason and Rachael, another observer recorded the behaviors of Mum and Tim, a third observer recorded Doug, while a fourth operated the video recorder. In the tenth grade classroom an observer was assigned to Toya and David as well as separate observers for Mark and Lisa. An example of a running record is as follows:

Lesson: Life Skills **Students:** Jason and Rachael

Teachers: Richard and Sheila **Time Begun:** 10:05 **Coder:** Laurie

TIME	TEACHER ACTIVITY	CLASS ACTIVITY	JASON	RACHAEL
10:05	What were some of the goals you had on your time line?	listening - screen off	writing on time line listening - screen off	responds screen off
10:10	Look at reading number 3 and 8. "Are you headed for future shock?" Future Shock here - as soon as learn something - it's updated, have to learn something new		opens book	opens book
	Examples of future shock happened to you	class responds		
10:15				opens notebook to blank paper and writes/draws with pencil responds to question continues to write
10:17	Going on to page 528-529			continues to write
	Richard read excerpt from book *Future Shock* changes			
10:24	How to avoid or cope with future shock	responds	listening	continues to write
	Discussed changes in ACOT	next year - Mac II		
	Look at reading 10 "Preserving the Life of Our Nation and Our World" "How Can We Become Involved in Country's Political Life?"		listening	listening
		collect time lines		

The running records were intended to do the following: 1) to capture each student's behaviors and the context in which the behavior was occurring; and 2) to be used as a basis for debriefing students about what they were doing, especially in terms of what they were thinking. For example, after each lesson these records were used as a basis for debriefing/interviewing each student.

Daily debriefings/interviews...

Within 24 hours of each lesson, each student was debriefed regarding their behavior during the previous day's writing lesson. The debriefings were held on a one-to-one basis with the observer and/or the investigator. Students were asked to explain what each was thinking during the course of the lesson. To reestablish the context of segments of the lesson, students were referred to the running records (including notes pertaining to their behavior). Initial questions were open-ended (e.g., could you tell me what you were thinking when the teacher directed you to ———?). To extend responses, reflective listening techniques were used (e.g., you said "you...", could you tell me more?), and, if necessary, specific questions were asked. Specific probes were also initiated to address the role of the computer.

All debriefings were taperecorded and transcribed. Transcriptions of these interviews are in Volume II.

General interview...

Upon the completion of all observations and debriefings, the general interview was conducted in an effort to gain a broader perspective on the role of the computer in students' reading, writing, and thinking skills and their attitudes toward the computers. The areas addressed in this interview were defined by the observers and the principal investigator with input from the ACOT staff.

Areas addressed in this interview were as follows:

1. What do you like about being in the computer classroom?

   a. What do you prefer about the computer classroom over a regular classroom?

   b. Why do you like these things?

2. Is there anything you dislike about this classroom?

   a. What do you dislike about the computer classroom?

   b. Why do you dislike these things?

3. How would you change things to suite your wants and needs better?

4. Do you like having the computer at home? Why?

   a. Do you dislike having the computer at home?

   b. How has having the computer at home helped you with your school work?

   c. What do you use it for besides homework?

   d. Does it help you to do your homework differently than you used to? How? Why?

5. Does having a computer on your desk at school help with lecture? Class exercises, homework?

   a. How? What would you like to have changed?

6. Discuss each subject area—math, science life skills, English—in terms of how the computer helps or interferes.

7. How has the computer changed/improved your organizational skills? In respect to writing for class? Organizing your time? Doing your homework?

   a. How do you approach/think about/do school work in class, study hall, and home differently now that you are in the computer classroom?

8. How do you approach writing assignments now, and how and when specifically, do you use the computer in doing these assignments?

   a. Do you also use pencil and paper for short term notes, ideas, while using the computer for writing?

b. How does the computer help you think through what you are going to write? After you have written, how does it help you make minor changes, major revisions?

9. What do you enjoy/do most on the computer?

   a. What do you dislike/do least on the computer?

10. Are you able to do much networking in class? What types of networking experiences would you like to have? ,—with the teacher? —with the other students?

11. What do you consider are the most important things you have learned to do on the computer?

    a. What do you consider the least important?

    b. What has been the most exciting experience with the computer?

    c. What were your most frustrating experiences?

12. What would you like to tell the teachers, school system, researchers, or Apple about your experience with ACOT?

    a. Does school seem easier or harder now? More boring or more interesting? More relevant to the rest of your life? More challenging?

13. How do you compare yourself/your sense of knowledge with other students who are not in the computer classroom? What do other students think about this experience?

14. How would you feel if you had to give up your computers right now and go back to the regular classroom?

15. How have your experiences here lived up to your expectations?

These interviews were held on a one-to-one basis with the observer and/or the investigator. All debriefings were tape recorded and transcribed. Transcriptions of these interviews are included in Volume II.

Analyzing the data...

TRANSCRIBING THE INTERVIEWS: All of the interviews were transcribed and, in turn checked against each of the original tape-recorded interviews.

CODING OF INTERVIEWS: Categories for coding the various comments of each student were extended from last year's coding categories. New categories were developed and old categories augmented to better capture the comments made by this year's ninth and tenth graders.

To code the interview, the original observer and an outside person reviewed and independently coded each comment offered by the student.

Two sets of coding categories were developed: one set for the students' debriefing interview comments related to the sequence of English/social studies lessons that involved reading and writing activities; and a second set for the disassociates' interviews. A listing of the codings with determinations follows:

Language Activities

P - PROCEDURE

1 Prefatory Activities
2 Topic Selection
3 Purpose
4 Audience
  a Audience
  b Intended
5 Planning
  a Generation
  b Elaboration
  c Organization
  d Selection/Narrowing
6 Drafting
  a Content
  b Layout
  c Form
7 Revising
  a Content
  b Layout
  c Form
8 Sharing
  a Text
  b Strategies/Process
  c Reaction/Interpretation
  d Other

T - TYPE

1 Poem
2 Report
3 Letters
4 Narrative
5 Interview
6 Survey
7 Play
8 Autobiography
9 Journal
10 Notes
11 Homework
12 Film
13 Class Reading
14 Class Discussion
15 Hypercard
16 Drawing
17 Keyboarding

S - SUPPORT

1 Peer
2 Teacher
3 Self
4 Other

M - MODE

c Computer
nc Noncoputer

A - AFFECTIVE

\+ Positive
\- Negative
/ Informative

G - GENERAL

1 Interactions
  a students
  b teachers
  c computers
  d family
2 Comparisons with other classes
3 Classroom Organization
  a teaching styles
  b course content
  c physical spaec/time/ layout/ logistics
4 Home Use
  a family
  b business
  c personal

Disassociate Coding

R - Reasons for Leaving

1 physical immobility
2 Social interaction with peer group
3 social interaction with faculty
4 physical setting and atmosphere
5 academic expectations
6 Educational choices
7 Learning style preference
  a affective
  b cognitive
  c sensory
  d intuitive

C - Carryovers

1 Beneficial
2 Disadvantages

SR - Student Recommendations
PR - Predicaments

GENERAL INTERVIEW CODING CATEGORIES: Comments offered by the students in response to the general interview addressed a wide variety of topics ranging from interactions with peers to home use of computers. Five general categories were developed and several subcategories as a way of differentiating the comments. Each comment was assigned a code from the procedure category. Other codes were assigned as appropriate and whenever possible, comments were also labelled as positive, negative, or neutral, as well as whether the comment pertained to the computer hardware or software.

To illustrate, consider some of Mum's comments and their coding, as well as comments from Doug and Rachael.

P6AT4S3	Mum	Part of it is like, you know when I write things, when you write something you always learn new things from what you write, you know? And that's the way I feel when I write the family data
	Interviewer	Do you find it's easier to write to do stories on the computer, than writing them out by hand? Does this help your thinking?
P6cMc+	Rachael	Well, lately it's been easier on the computer and I have some nice copy right in front of you. And you see your mistakes a lot easier on the computer 'cause it's right here, and when you're like writing down stuff you always skip over it cause you're like (?)Well, this doesn't make any sense.
	Interviewer	While you were writing were you doing any changes in your story; were you deleting words, were you changing lines?

P7aT4S3	Doug	Some things, like I was adding more to it and taking out some of it and end everything.

Many times comments were double coded: one comment from a student refers to more than one major 'procedure' category like this comment by Tim.

P5abT26S4 P6bT6S3	Tim	Well, a little bit. I just went up to people I knew and a couple people on the block and told them I was doing a report about Reagan and I ran out of things to write about him and I was taking a survey about him, what you thought about him and how he's doing this year and stuff like that. And then I took and compiled it into a graph chart and a little summary

To to enhance interrater reliability in coding at the level of subcategories, 30% of the interviews were coded by more than one person to check for consistency.

Thought Processes Engaged by the ACOT Students in Response to Reading and Writing Related Activities Ninth Graders: Year One

Thought Processes Engaged by the ACOT Students in Response to Reading and Writing Related Activities

Ninth Graders: Year One

In 1987, the ACOT program was enlarged to include two grade levels—ninth grade and tenth grade. The tenth graders were in their second year of ACOT; the ninth graders were new enrollees. The present chapter describes the findings from our observations of ninth graders who entered the ACOT program in 1987. Again, these students represented the second group of enrollees to participate in the ACOT experience.

The goal of our study was two-fold: to pursue a longitudinal study of the engagement of thought processes which paralleled the study continued for tenth graders; to compare the experience of these new enrollees with the first year experience of their counterparts not in tenth grade. An obvious benefit was the comparative perspective. By allowing for comparisons with their predecessors we would be able to attain a clearer view of how and to what extent the influence of computer-based technologies upon thought processes.

Our research team observed and interviewed five ninth graders three times during the school year for two sessions each. Observations and videotaping took place in the morning during the students' combined English/Life Skills class, from approximately 9:30-11:15. Minute by minute running records of teacher and class activity were collected at the same time as the writing behaviors and computer interactions of the five students were recorded. In turn, these running records were used as a basis for developing individual student interviews. Interviews followed these sessions during student study

halls. Our approach was identical as was used with the procedures that we enlisted with the tenth graders. Namely, it involved: 1) observation to investigate student behavior while writing with the computer; 2) daily interviewing to probe the nature of the thinking engaged in by students during reading and writing (the research team also conducted lengthy interviews in order to obtain background information about each student and his/her writing history); and 3) the collection of texts in all stages of development. These data, in the form of videotaped observations, observational record sheets, and extensive interviews were then logged or transcribed, coded, and analyzed.

Description of students

Five students of various abilities and backgrounds agreed to participate in the study. They were:

Mum Kaun, 13, was born in Cambodia and came to the U.S. when she was nine years old. While shy, she was cooperative, articulate, and reflective in interviews and observations. She enjoys reading, drawing, and writing letters. Her out of school writing is confined to a personal notebook where she writes about painful experiences with the Khmer Rouge. (ACOT is her first experience with the computer.) She is a very capable student who is experiencing success with ACOT.

Tim Leslein, 15, has lived in Columbus all his life, with most of his family nearby. He seems to be enjoying the ACOT experience and seems to be keeping up with the work. While Tim seemed nervous, interviews were relaxed and informative. Tim's interests include heavy metal music, wrestling, and hunting.

Jason Martin, 14, is an only child who was promoted from grade 6 to grade 8. He has been working with computers at home and at school since grade 3. He is cooperative when being observed but

seemed reluctant to make the time for interviews. His passion is skateboarding; his interests include stunt biking, computer games, and drawing with the computer.

Doug Moreland, 15, lives in Columbus and spends a great deal of time with his grandmother. ACOT is his first experience with the computer. At times, he seems to lag behind other students in terms of deadlines and the work load. He is very social; interests include reading realistic novels, talking with friends, and rap music.

Rachael Rhodes, 15, has lived in Columbus all her life, with most of her family nearby. Partly as a result of her lack of keyboarding skills, she was initially uneasy with the computer. When being interviewed was articulate and gracious. Her interests include reading, writing, rock music, and classic cars. Rachael's writing has been recognized in local contests and publications.

The thought processes engaged by students during reading and writing

- Over year one, student use of the computer changed from feelings of frustration (having a preference for handwritten notes, etc.) to feelings of self confidence with their well integrated use of the computer.

  At the start of the year, the ninth graders offered comments similar to the following. As Rachael stated,

  > ...some things are easier to do on the keyboard than write and some things are easier to write down.

  Tim gave a somewhat different view as he said,

> It's easier to write than it is to type something so I sit there and scribble it out and then I'll write it down like tonight, I'll write down today and yesterday's notes on the computer.

Doug voiced a similar reaction saying,

> 'Cause it's easier to write. Well, I write stories or descriptions...see what I do is write it down on the paper and then revise that so I know what I'm going to write down so I don't have to change anything when I go to type it up.

By the end of the year, comments similar to the following were more characteristic. As Rachael commented when asked if it was easier to do stories on the computer,

> Yeah, it's funner too.

Tim said,

> ...But I want to do it on the computer, I can do more to it. I can always change it and stuff, make it move.

Doug also did a turnaround as evidenced by his saying,

> It's easier to think them and type them into the computer....'Cause then you don't have to go through the trouble of writing it down on paper and then transferring it on to the computer.

Mum concurred by stating,

> Yes, I kind of think that computer does help writing...and you know with computer, I don't

have to go find eraser and erase the whole thing and start over again and have another piece of paper, but with computer, you just click on what you want to erase and then just start writing again. It's easier instead of using eraser and a piece of paper.

- At the beginning of year one, the students' research of a topic tended to be limited to their own thoughts and what teachers did to prompt thinking. By the end of year one, the students' use of resources extended to peer input from within and across classes, incorporation of what they read, and the very careful consideration of how their projects might be enhanced by graphics. In this regard, the ninth grade students seemed more sensitive to the use of graphics than their tenth grade counterparts.

- The aforementioned development reflected a change in their repertoire of planning behaviors. Over the course of the first year, the students demonstrated an expanding repertoire of planning behaviors as they considered topics and what they might write. Where at the beginning of the year, the majority of students tended to restrict their planning to a consideration of genre and what they knew about a topic based upon teacher input, by the end of the year, planning by students was more expansive. It involved being more sensitive to audience, entertaining the integration of graphics, and the inclusion of a wide array of ideas which included suggestions from peers and those suggestions which the students found significant.

- Over the course of the year, handwritten jot lists (used in preparation for writing) gave way to more complex mental representations which students thought through both before and during drafting.

- Over the course of the year the extensive graphic options available with the Macintosh became a vital feature in student writing. Graphics appeared to complement and supplement both the development and presentation of ideas. The graphic capabilities of the Macintosh guided rhetorical discussions and provided the students with scaffolding for the exploration and development of ideas. It was as if the potential for graphics with the Macintosh assumed a very important role in not just motivating writing, but also in forming and prompting thinking.

  The teachers commented that for many students the graphics were a means of (initially) engaging students in their writing. Sheila indicated, "For some kids it helps them get going." Graphics were seen as a motivating force for many students. As Jason commented,

  > That's the main thing I like about the computers is how they can draw so well and stuff, make it move. ...you can change different styles of writing.

  Rachael found it easier to do stories on the computer and said,

  > Yeah, it's funner too.

  Mum explained some her ideas when she said,

  > Some of the designs, you just double click on the pattern and you can change the way you want it, you can add things or take away things. ...and then I will write them in plain instead of bold and I want the title in bold because you know people would catch the title and then if

> they see that title might be interesting they will read the plain text.

When asked if it was more meaningful to have a chart on the computer which he could manipulate or to do it with pencil and paper, Doug said,

> Yeah, cause you can get it a lot straighter and a lot better, how you want it, makes it look better.

- Apart from fueling the development of texts, the graphic potential of the Macintosh also enhanced visualization and imaging. As student comments suggested, oftentimes ideas were encoded aesthetically as visual images yielding qualities not readily captured in words. As Rachael stated,

> I can like picture what was happening.

Jason echoed Rachael's statement when he said,

> I just sort of daydream about it till it sounds good.

Jason's comment in response to "Did you have a picture in your mind?" was,

> Yeah, she I figured her as being, you know around 18 and her mom and dad in their middle ages and stuff.

When writing a letter to a senior citizen, he said,

> I wish I knew what she looked like. I could say stuff easier. I mean if I knew she was a really spunky little grandma, then I could say some of that stuff.

- The types of refinement and revision varied over the course of year one. At the beginning of the year, the students appeared to be concerned with surface features such as mechanics and the order of sentences. At the end of the year, students had moved to being concerned with larger issues. In particular, students appeared to become more sensitive to their voice, point of view, audience and the ideas being presented. Typical of the comments offered by students at the beginning of the year were the following:

  Rachael's characterized her revising by saying,

  > I don't usually move the sentences around....I went back through them and I corrected the spellings and some of the words didn't sound right and I added an ending on one of them.

  Jason explained his process as,

  > I like maybe write a sentence and look it over. Just used the computer like a spell checker. (I don't think about making paragraphs or corrections), not 'till the teacher comes around.

  Mum said,

  > No when I start writing, I don't choose the point of view, it just come out as "she", "it", "I", you know. It just come out like that. I don't really choose what point of view I want to write. I just start typing as naturally as the point of view.

  Doug commented that,

  > I was just thinking about what I was going to put in there...I worked on one after the other. If there

needs to paragraphs, commas and periods and make sure it (?)

By the end of the year, comments had changed. Rachael seemed more comfortable and willing to make changes as she said,

> On the computer you can make a long thing and if you don't like it you can change it real easy....Yeah, in a few ways...I like it better printed, it's interesting 'cause everything is all nice and neat. It just seems a lot different.

Jason was more enthusiastic and looked at his text in larger chunks for revision. This was apparent when he said,

> ...but I want to do it on the computer. I can do more to it. I can always change it and stuff, make it move....as I went I'd see like if there's a few lines like if I'd finish a paragraph, I'd look at the paragraph.

Mum was very reflective in her approach as she said,

> Well, I read the story over and then some of the typing aren't very good, kind of have too many words or something, but when I read the story again. Like I say I want it to flow and I want it to make sense to the people who reads it. Sometimes I change the whole thing or change the sentences of the story just to reverse it or saying in a different way so people can understand more....I change some words because when I write a paragraph I go over and read it over again and then if I use too

much of the same word I change it and then delete some paragraphs I don't like....

Other features of student learning in the ACOT classroom

Several other features of student learning associated with the ACOT classrooms were discussed by the ninth grade students in year one.

- As a result of ACOT, students were introduced to desktop publishing, electronic networking, and various software for the management, storage, and layout of files. By the end of year one they were competent at word processing; data file management, the generation, integration of graphics, and layouts.

- At the beginning of the year several of the students expressed a great deal of frustration with computer-based learning. By the end of the year, frustration had dissipated and given way to fluency. By year's end the students used the computer more readily than paper and pencil.

- Several of the students' comments suggested that they felt as if they learned more dynamically with the computer. All of the students mentioned the computer helped them to learn more. Several students preferred the increased pacing the computer affords. Also, (as discussed previously) the graphic capabilities of the Macintosh appeared to have a significant contribution to the approach students were adopting to the exploration of topics.

- Several students felt as if ACOT was more demanding than the regular school. Mum, for example, suggested that ACOT students work harder and are more challenged. Tim felt as if ACOT students had more homework.

- The year nine students (as with the year ten students) preferred the ACOT classroom over the regular classroom. They liked the support that the teachers, peers and the tenth graders provided them.

- The year nine students (as with the year ten students) used the computers at home for both school-related and personal tasks. They did their homework on them and used the computer for a variety of other purposes (e.g., playing games, creating schedules). Parents occasionally used the computer to play games with their son or daughter, monitor homework and to do their own correspondence or work related activities.

Thought Processes Engaged by the ACOT Students In Response to Reading and Writing Related Activities Tenth Graders: Year Two

Thought Processes Engaged by the ACOT Students in Response to Reading and Writing Related Activities

Tenth Graders: Year Two

In year one, four students were selected by the ACOT staff to participate in the study and were observed and interviewed in April and May. Observations were made in conjunction with reading and writing-related activities stemming from a discussion of the future (medical advances, technology, etc., as well as death and dying). In year two, the tenth graders were observed in March. During that time they participated in a unit on the multicultural aspects of American society. The teachers made use of a Bill Cosby film on racism, clippings from newspapers, and readings from the tenth grade literature book to prompt the writing assignments. The following examples of writing prompts are representative of the prompts used in the unit: as the president of the student council write a letter to a foreign student to help him become familiar with American customs, write a survival guide for aliens in which the alien is given hints on how to get along in American society, write about a time when a familiar traditional holiday was observed in a different manner than usual, and how do you define a good American?

Debriefing interviews were conducted with the students in order to talk about the nature of the thought processes they engaged during writing and writing-related activities. A general interview was also conducted in which the students were asked to comment on general themes related to the ACOT classroom. The general interview was identical to the one used last year. Both sets of interviews were coded and analyzed in accordance with the procedures detailed in the methods section.

Description of Students

The students observed in year two were the same as those observed in year one. They were:

Toya, a black female, has remained consistently successful academically and is a competent computer user. She enjoys making use of new innovations and is not intimidated by them. Her career goal is to go into computer science. Toya enjoys reading, writing, and computer games. She is very social and prefers to write collaboratively. Study halls are spent interacting with her peers as much as spending time on homework. Toya was reluctant to spend time in interviews, but once she made the time was helpful and gave reflective responses.

David is a competent student and computer user. He articulated very clearly his writing process and his knowledge of computers. His interests are in computers and related technology and he used his computer at home to explore new software. He enjoyed desktop publishing and volunteered to do layout work on school publications. David became very skilled in using Hypercard in a short period of time and he co-authored a Hypercard stack that integrated multiple technologies.

Lisa has experienced some success as an ACOT student. She seems still quite shy but was informative during the interviews. Lisa enjoyed writing stories at home on the computer during her free time and she placed in a local Martin Luther King Jr. essay contest. Lisa's career goal is to become a legal secretary or a lawyer. She commented on how her experience in ACOT could help her achieve that goal. Lisa was part of a tight knit circle of friends that collaborated on projects and helped each other through peer revision.

Mark enjoyed sports and he used what he learned in school to help him with his hobbies. He set up an Excel document to keep track of

the statistics of his favorite sports figures and he thought of some possible use for Hypercard to keep the stats of football players. Mark enjoys sharing his writing with the other students. As in year one, Mark was absent for the majority of the year two unit.

Thought processes engaged by students in conjunction with reading and writing

- Whereas in year one most of the students' comments about prewriting made minimal reference to the computer, in year two each of the students made repeated references to using the computer.

- Over the course of two years, the students planning strategies were influenced by the flexibility provided by the computer. The ease with which text can be edited and revised on the computer allowed them to be able to type their ideas into the computer and later add to them or expand them. Because of this ease of revision, some students didn't feel the need for a jot list; others used jot lists which they modified and revised. Toya put her list of ideas on the computer,

  > Um, I used to have to jot, jot some ideas down, so I wouldn't forget 'em and now on the computer I just, all I have to do is just type 'em and I can come back to 'em and have more ideas and just add to them.

  Lisa also keeps her ideas on the computer,

  > First I just sit there and stare at it. Cause you can just always build up all these ideas and type on there. Usually, I just type in ideas....

David made use of mental lists of ideas but he did say that if he was writing a longer piece he would write something down,

> Usually when I'm just writing something, I have it in my head and I don't usually have a jot list or an outline written out. But if I'm doing something like a long writing assignment or a report or something, then I'll usually have something written down, so I can have my thoughts organized better.

Mark sometimes puts his ideas in the computer and at other times on paper,

> Sometimes I just put them on the computer and sometimes I just put them on paper.

- The planning that students pursued represented considerations for genre, sources available for researching a topic, logistical constraints such as deadline, length, etc., and the importance of instilling a point of view which was personally significant.

- In year one, the students' research of a topic was limited to their own thoughts and what the teachers did to prompt thinking. To this end, their teachers showed them films, assigned readings, discussed topics and distributed samples of related class work. In year two, the students' also made extensive use of peer input. All of the students solicited reactions from classmates for reactions as they explored plans for their texts.

- As with year one, the tenth grade students made extensive use of the computer for purposes of developing and refining their thoughts. Furthermore, they remained cognizant

of the extent to which computers expedited on-line revisions, revamping of ideas, and final production. In year two the students continued to approach their exploration of topics across more than one draft. Early drafts were used for purposes of exploring and expanding ideas; later drafts were used for purposes of editing. Sharing with peers and printouts to achieve some distance on their own text.

- The types of revisions students pursued on-line varied from year one to year two. In year one the students' comments suggested that their revisions were restricted to additions and corrections. In year two, revisions included more substantial changes including reshaping and reorganizing their texts on line.

- There appeared to be a growing realization of the worth of obtaining outside reviews, and, as a result, an increase in the number of self-initiated requests for peer input from year one to year two. As Toya stated,

> 'cause I like to have other's opinions about my paper, to make suggestions...and I really take those very seriously.

Mark looked at peer revision as a step in moving beyond himself as an audience for his writing to presenting his writing to a larger community.

> Yeah, I like to share it with people 'cause I want their opinion a lot. Cause I don't want it, if nobody likes it then I don't want to take it out and go show it to other people around.

David stated,

> We had someone else look at the paper and I looked at what I said about it, What it needed changing and I kinda used that as a guideline and some thoughts that I had later about the paper.

- The students have the opinion that their writing has changed due to access to the computer and the variety of software that they used. David believes that the computer has contributed to his fluency and ability to produce better organized text as he stated,

> I think it's, I've added a little bit as far as length, and how much I put into it and I think it's become a little bit more rounded off. It's you know, I'm thinking more about my sentence structure. Does this sentence sound good, or how organized my thoughts are. I think I'm organizing my ideas more now than I was last year. Whereas, last year I might type it out in a frenzy, this year, I think a little bit more what order I'm going to put it in, where if I don't like where one paragraph is I'll paste it into a different part.

Toya suggested that she finds writing easier. As she stated,

> Yes, well, I can express myself more with, when I can type it out easily, the words come easily. Instead of having to write it out now, I can type it out and I can type a lot more now.

Mark suggested that his confidence has increased as well as the quality improved. As he stated,

> When I was in the eighth grade we didn't really write a lot of stories so I had very basic

> knowledge about how to write, you know I couldn't brainstorm that well. But now that I've gotten older, I think that I work better, I'm more confident.
>
> Well, see last year, you know, I didn't think I wrote that well, you know. I got better at writing, but last year, you know I wasn't really confident in my work and I didn't want to share it, but now that I write more I like to share it more because I think my writing's better now.

Lisa stated that the computer has facilitated self expression and better synthesis.

> First I just sit there and stare at it. 'Cause you can just always build up all these ideas and type on there. Usually, I just type in ideas. Then I organize them all down to a synthesis. Then I sit there again and try to make it up into a paragraph. It's hard. But I mostly like to do law topics. I get to express my feelings and they can't do nothing about it.

- As in year one, the current use of computers still appears to limit the use of notes or comments to overlay and guide improvements of text.

Other features of student learning in the ACOT classroom

Several features of the ACOT classrooms were discussed by the students in year one and again in year two. What follows is based upon an examination of their comments across the two years.

- Students claimed that the knowledge they had gained from the ACOT experience was valuable. Those capabilities singled out by the students were the desktop publishing capabilities and Hypercard.

- Over the course of the two years students have developed enormous skill with the computer and use it more readily than paper and pencil. The software with which they have had experience has afforded: 1) opportunities to problem-solve using computer-based simulation, 2) support for the visual representation of ideas and the integration of visuals (graphs, charts, diagrams, animation, video) with written representation, and 3) facility to evaluate and revise their ideas in conjunction with the ease with which ideas can be refined or altered.

- In year one the students did <u>not</u> claim that they learned differently with the computer, but that it was more challenging. In year two, several students commented that Hypercard and computer-based robotics afforded more dynamic learning procedures.

- Some students still appeared to experience occasional frustrations with the computer. Lisa, for example, felt some frustration with the use of Hypercard.

- Some complaints persisted from year one:
  - the difficulty incurred in reading the screen
  - the lack of access to computers during afternoon class
  - disk crashes

- All the students interviewed preferred the ACOT classroom over the regular classroom. One student characterized the class as "one big happy family" and the students said that they liked the interactions between the students and the

teachers. They felt that in the ACOT classroom they were able to help one another and the students were more willing to "approach" one another. Most of the students mentioned that the scheduling was a problem. The students spent large blocks of time in the ACOT classroom and they wished that they could be more integrated with the rest of the school. As Toya said,

> ...it's a lot more challenging than the regular classes and it's like we're a whole big family around here. And everybody's real close and that's what I like about ACOT.

David stated,

> I like being able to interact with the students more. I like it that we...it's easier to ask another student about something you might not understand or you know people are more willing to approach other students, and that's one of the things I like about that I noticed in my other classes outside of ACOT.

- The students used the computers at home for both school related tasks and personal tasks. They did their homework on them and they also used them to develop their personal interests like experimenting with new software or writing stories. David explained,

> It gives me more time to experiment with different things and of course it lets you do your homework, too, but if you want to develop interests with the Macintosh that are outside the classroom then you can use it for that. You know

> you could kind of go off in your own direction which is something I like.

Toya's elaborated by saying,

> When I'm at home I just play on the games since we're not allowed to play in there. And so I just use that time to, uh, I kinda try to develop my typing skills a little more.

Their family members used the computers to play games with their son or daughter, pursue occasional correspondence, and to do their own work-related activities.

- The students commented on how much they were learning in the ACOT classroom and that the class had more than met their expectations. They didn't expect to learn so many different ways to use the computer and they didn't expect to be as fluent with it. David recalled,

> I think they've exceeded them because I like last year, when I started here, I didn't know what was going on, but I thought it would be mainly word processing.

Toya stated,

> (my family will) look over my shoulder and they're amazed at what I can do on the computer.

- They said that they would be disappointed and bored if they had returned to the regular classroom. As David said,

I'd be a little disappointed because right now, we're looking at a lot of different things and I'm looking forward to learning those.

ACOT and Its Impact Upon Disassociated Students

ACOT and Its Impact Upon Disassociated Students

"Disassociates" is a term used by us to identify students who chose to exit the ACOT program and return to the regular classroom. After the ninth grade, five students left the ACOT program and reentered the regular high school program. In an attempt to achieve some further perspectives on the ACOT experience and its impact upon students' thinking and learning, a study was launched which focussed upon the disassociates. The goal of the study was to assess two key issues: the extent to which there were carryovers related to ACOT for these disassociates; and the perspectives of the disassociates on their ACOT experience.

The possibility of studying the "disassociates" represented a rather unique opportunity. First, their comments pertaining to the ACOT experience were informed by a comparative perspective acquired from their experience in both ACOT and the 'regular' high school. Second, these students did not appear to have any vested interest in ACOT. Indeed, there existed the possibility that they might be overly negative in conjunction with an attempt to rationalize their disassociation from ACOT. Third, these students allowed for an examination of the extent to which ACOT had effects beyond the immediate or effects which were specific to the ACOT environment and not beyond. In other words, two important benefits which seem to emerge were an opportunity for the following: to assess what students carry with them as they move on to other experiences outside of the ACOT classroom; and to attain an alternative perspective on the strengths and weaknesses of the existing program.

Description of students

Andy is a male Caucasian tenth grader student. He lists among his many interests playing his horn (the trombone) and girls. Andy chose to disassociate himself from ACOT for the following reasons: a desire for more social interaction between peers and faculty; academic expectations were not great enough in the area of creativity (e.g., journal writing); problems with equipment breakdown; and ACOT class periods did not allow socialization with the rest of the school. The ACOT teachers described Andy as "wonderful," "artistic," "self-destructive" (when he dropped a firecracker down the bell of his horn), and "...wonderful if you could get him to do assignments, the kind that made you want to shout for joy." In addition to Andy's reasons of wanting to pursue music and social skills, the ACOT teachers felt that there was a great deal of anxiety experienced in areas of math and science and apparently during the current school year he experienced difficulties in Geometry as well.

David is a male student in the tenth grade who reports himself as black. There is, however, some confusion over this since it appears that he is Hispanic. David's main interest is hunting which is a strong family activity, removing him from the classroom for rather long periods during hunting season. David's reasons for leaving appear to center around a lack of parental interest and support in the program. This expressed itself in his lack of interest in completing the work and was supported with the father feeling that computers were not necessary for building a business in family construction. The teachers described David as someone who made "...very insightful comments during discussion," "who liked to read" and "who had an unusual home setting." They added that they felt that "a big part of it was that he really didn't want to do all the work."

Keith is a male Caucasian student who is academically somewhere between tenth and eleventh grade in his high school requirements. He has been involved in visual and graphic arts for some time. It

appeared at first that Keith was reluctant to discuss his ACOT experience. Once the interview had begun he listed some very interesting opinions and reasons for disassociation. Among these reasons were: social isolation from the rest of the high school students and academic expectations. The teachers in ACOT described Keith as a person who, "liked to march to his own tune" and a "science fiction writer of the story, 'Lost Planet of Zetro.'" The main reason that Keith left ACOT was because "he failed English and science." Apparently, the parents currently are petitioning to have him reinstated.

As we have indicated, five students from the 1986-87 ACOT classroom chose to remove themselves from the program for the 1987-88 school year. Unfortunately, a great deal of difficulty was incurred in locating these five students, and indeed only three out of the five were eventually interviewed. Difficulties in locating even the existing three appeared to stem from lack of accessibility in scheduling time and in lack of interest regarding participation in such an interview process. One student, for example was contacted at home and school for three weeks before agreeing, reluctantly, to participate.

In addition to interviewing these three disassociates, there was a strong attempt made to obtain current school year writing samples. This attempt proved interesting in that all samples submitted of both writing and graphics had been completed while the students were still involved in ACOT. Students were unwilling to submit samples of work from the 1987-88 school year.

Interviews

Interviews were conducted on a one to one basis in April, May and June of 1988. The interview took the form of an open-ended conversation which addressed the following topics:

Reasons for leaving ACOT

Carryovers from the ACOT experiences

ACOT experience—likes, dislikes, recommendations

Regular school curriculum—likes, dislikes

The interviews were tape recorded and transcribed. After transcription, they were coded. Transcriptions are included in Volume II.

FINDINGS

Carryovers from the ACOT experience

The three students indicated that they had benefited from the ACOT experience and had gained expertise which afforded them some benefits in their 'regular' school experience and 'outside' school. All of the students identified the word processing abilities, including desktop publishing skills that they had attained as being most beneficial. They felt as if the quality of their writing (surface features such as grammar, layout) was improved and that they were more disciplined writers (e.g., more control of the process).

- Two of the students suggested that certain data management capabilities (e.g., spread sheets) had a carryover. Andy, talking about his writing and technical skills said,

> I learned how to take notes last year on the computer, like setting it up, the subtitles, and I do the same thing this year in my writing.

> Computer use, the skills involved in that. Learning more about word processing and spread sheets and data and stuff like that.

David commented that,

> Probably it taught me to be a better writer, you know just from that year in there. When I started high school and going through with that effort, then it taught me to do that much effort next year....
>
> The mechanics, I guess. Like how the...where the paragraphs and all that are and that sort of thing.

- Some of the aforementioned comments should be coupled with comments by the students that they felt as if they were in a predicament. Each student commented on the lack of opportunity arising within the general classroom curriculum to incorporate skills which were developed in ACOT. As Keith commented:

> There's nothing I do in school right now that I wish I had a computer for....Mostly my teachers don't want me to type them up anyhow, cause it's free handwriting....(Do you do anything with writing? (In English class)) Hardly any, except on tests.

Andy did not think there was much carryover into this year's classes, as he said:

> Yeah, well it was, formatting was all right, but I didn't really learn anything to bring into this year with that. Just stuff that I could do on the

> computer that helped me to format my writing on the computer, but now I'm over there at English Challenge class, it just changed and I don't do anything different.

David found word processing useful, but said:

> ...Well it would be the typing part of it, cause I can't use that now. It's still an important part to me, but it's just that I can't use it. I'm still glad I learned that.

- Some of the students maintain a link with ACOT. Occasionally, they return to interact with classmates or teachers. Sometimes they have ACOT students assist with their files including typing, formatting, and printing them out..

Reasons for leaving

Many of the students comments were directed at explaining their reasons for leaving. Taken together, their comments suggest that they felt as if the ACOT classroom experience was overly constrained in terms of the social interactions afforded (especially with students outside ACOT), tended to be more formal than some liked and had academic expectations, as well as work demands which some felt were too demanding. More specifically, the comments by students suggested the following reasons for leaving.

- An oft repeated refrain, by disassociates and active ACOT students alike, is that there is not enough interaction with the rest of the high school. This lack of outside contact appeared to affect Andy most significantly:

> ...Cause when you first come to West and you get into a computer program, you stay in it for six periods, you feel like you're missing out on what's really going on....I like it better out of ACOT and it's a lot more experience in high school...It's just I like it better. It's a lot more fun....(regarding recommendations)...But at least give us some time between ACOT sitting to have, to get out and be with other students in the halls and stuff.

Keith seemed to feel isolation from the high school at large as well as within the ACOT classroom since he said:

> (regarding interaction with teachers) Oh, like one side of the room was personally part of let's see, we're on one half, and on the other half; this half was like, when we'd split the room, there's girls on this side and kind of upperclassmen, you might say. Not jocks and stuff like that. It seems like they are more free to talk to and they're always there and we were on this side of the room and they were always over there, just there.

> (regarding peers) Yeah, I knew nobody in the classroom, except I know one person vaguely, but he was way over there and he knew a couple of people and I was by myself....I didn't know these people personally.

David, too, felt there was a need for contact with other students in the high school when he commented:

> I think the ACOT is a good program except for the kids interacting with other kids.

- Long periods of immobility seemed to be an independent issue, as well as being tied to the interaction issue. As Andy explained:

> Well, basically just sitting in the computer room for six periods with just small breaks in between....The reasons I quit were some of the disadvantages with the periods being so close together, no breaks hardly, same teachers, looking at the computer screen for that long sort of gives me a headache almost everyday.

For David, it appeared to be tied to the need for interaction as indicated by his comment:

> ...it would be good then the kids would change classes and interact.

- Atmosphere and physical setting were items of concern for all three students. As Andy commented:

> ...I really don't like the classroom setting or the classroom atmosphere....The computers and printers are always going and you're just sitting in front of a computer for six periods of the day.

Keith's discomfort in the ACOT classroom was made quite clear when he stated:

> Atmosphere now...last year it was real guinea pigs. It seems you were more like an experiment than you did a person.

David's reaction was consistent with Keith and Andy with the added concern of noise level in the room. He said:

> I like, like now I can you know, change around in the different classrooms and you see different people and get more interactive with school and with projects in the school...And you know in the classroom it was never quiet, there was always something going on.

- Academic performance, related to and independent of computer fluency, was commented on by all three students. For Andy, it appeared that being graded on his ability with the computer in relation to the quality of the work he did was not a comfortable situation. As he stated:

> ...if a printer broker down and it had your homework printed up to be turned in you would be yelled at and they would blame it on you instead of the printer, when it couldn't be helped....the grading policy as in on the computer, is different because they grade you on how you do on the computer and what you do on the computer and in the regular classroom there's no computer so they are just grading you on your skills and writing and handing in your homework and stuff.

Keith commented on his experiences in social science class with Mr. Tracy by saying:

> Yeah, and I like that. Probably the only thing I passed too. ...but in that class, you gain, you stay gain, or if you lose, you're always lost....It seems like if I made a mistake they'd see it.

David seemed to feel that there was pressure to succeed, not just pass the course, and that the ACOT teachers had

more interest in how their students fared than did teachers in the regular classroom. David said:

> (regarding leaving ACOT)...Because for one reason, I had failed the last semester of science and they would have made me leave for that....the other teachers seem to not worry about you now. You know certain teachers, they'll let you go and do you own grade, but these teachers here, they seem to care about, what kind of grade you're going to get....at the end of the year they'll look back and say that the ACOT, oh, they all have a B average and the regular classroom has a C average...they'll probably compare these.

- Andy expressed dissatisfaction regarding having to do the ACOT log as he said:

> ...The only time we ever have a journal now is in English...In ACOT it was a pain.

Keith and David, respectively, made clear their similar feelings regarding the log:

- > ACOT seemed like, everything was do this and write something about it....It seemed like last year we had a continuous work load. This year seems to go along. I have some reading tonight, I do a little math here and there....It was the same thing. Over and over again. Everyday was just the same thing....these ACOT logs were different. You had to write on a topic everyday and I never did like that.

> It seemed like when I was writing for them, they would want things that would have to do with ACOT....When I'm out of that classroom and into another classroom, they aren't asking me to write about computers, or asking me to write about your own ideas.

- In accordance with the students somewhat idiosyncratic justification for leaving ACOT and their comments regarding current predicaments, they offered varied recommendations ranging from changes to computer access in the regular school to adjustments in the constraints of the ACOT experience. For example, schools, according to David, should have computers in each classroom. Keith would like to see the computer classroom emerge more in the affective and intuitive learning style combination—put succinctly, he felt left out socially: both with peers and faculty. Andy had some well thought out responses regarding noise levels and mechanical shut downs. His major recommendation, however, was to combine ACOT curriculum with noncomputer curriculum. This would allow students to get out into the halls and socialize.

The Social Nature of Cognition in ACOT

The Social Nature of Cognition in ACOT

Learning in the ACOT classroom is socially constituted. ACOT is a self-contained classroom situation in which students are placed with approximately 30 students at their grade level for five consecutive periods every morning. Five teachers work together as a team serving as the students' advisors and instructors for selected periods (math, science, life studies, and English). This past year the ACOT classroom situation extended to adjacent rooms which the students—ninth graders and tenth graders—went between for different class periods.

The students in each of the classrooms support each other in the following ways: formally, they are expected to work together in a variety of ways including: 1) for purposes of peer review in conjunction with writing or revising a draft; 2) for purposes of jointly developing/coauthoring a project; 3) to engage in cooperative learning activities (e.g., different students will assume different responsibilities for different portions of a project); 4) for networking electronically in order to review selected class members work or looking at different models of text.

Informally, the students help each other in a myriad of ways: 1) they circulate among themselves software such as graphics, icons; 2) they provide incidental assistance and encouragement to each other with problems which arise with using hardware or software; 3) they monitor each other's achievement (e.g., they spontaneously share finished work); and 4) they encourage more recalcitrant students to work with and support other students.

Apart from their interactions with the teachers and fellow ACOT students, there are numerous interactions with outsiders such as

occasional visitors, researchers, district-level supervisors, and teachers and students from the 'regular' high school.

Some comments on outcomes

The various collaborative experiences evident in the ACOT environment can be associated with a variety of important outcomes. These experiences appear to prompt the engagement of certain thought processes, influencing student attitudes to learning, including their view of themselves. Furthermore, they have contributed to the student's use of the computer as a tool.

Thought processes

- Encouragement to share their writing and obtain peer review during the planning and development of projects has impacted student composing procedures. Students consciously consider their readership when they are developing their text and when they are refining their products. Peers have given each other valuable feedback on: 1) how interesting their ideas were, 2) suggest additional resources that might be enlisted, 3) how coherent ideas were, 4) and suggestions for how text might be enhanced with graphics.

- The externalization of feedback through formal and informal peer review sessions appears to have prompted the development of internalized criteria by which students are apt to self assess both their writing and strategies for developing their texts.

- Within the research site is a network file server that has opened many possibilities for both students and teachers. The teachers' instructional use of networking is convenient and makes software directions and explanation more accessible to students. For students networking provides the means for sharing their writing with wider audiences and the comments of these readers gives immediate feedback on their writing. Student comments on each other's work appears to have increased interest, discussion, self assessment and the development of self monitoring procedures as readers and writers negotiate meaning—uniting personal and social world.

- The feedback, help, and support students have been encouraged to offer peers appears to have contributed to students' developing a "critical eye" and repertoire of possible strategies for composing or comprehending texts (their own text and those written by peers and professional authors).

Students attitude to learning

It is sometimes suggested that the technology of the computer privileges isolation over collaboration. In the ACOT environment striving for cooperation and collaboration moves more in the direction of a sense of community.

- ACOT students started in 1987 by exchanging graphics (sketches, clip art) and ended by borrowing Hypercard texts, audo and/or visual enhancement devices, and swapping stories and reports. ACOT students trade reading material back and forth—favorite books and magazines—and swap games and software information.

- The sense of community extends to teachers and others (researchers, Columbus City School staff, and Apple personnel). Several of the students suggested that the level of investment and the sincerity of the teachers contributes to a sense of "being a member of a family." This sense of family extends across the two classrooms and to associates of ACOT.

- Within the ACOT community students are respected for their expertise, enterprise, achievements, and effort. Students who developed expertise with certain software were used as resources by both their peers and the staff. Those students, who were struggling with certain problems (e.g., learning a new software) were not subjected to ridicule, but were given understanding, support and assistance. Students were not hesitant to request advice from others or offer help as they saw the need arise. Indeed, there existed a self-induced and self-imposed ethic among students to help each other.

- The students' access to technology is viewed by the students as a privilege and advantage which should be extended to others. For example, the ACOT staff and students assisted the school on a number of projects. The students assisted parents and neighbors as various projects. Also, noteworthy was the existence of an underground culture which afforded students outside of ACOT access to desktop publishing.

- The students value the ACOT experience as affording them opportunities to achieve special skills and expertise, as well as prepare them for the future. The students recognize the expertise they have achieved and what it affords for themselves and others. Lisa, for example, has developed a great deal of confidence in her word processing skills which

in turn has contributed to her self-confidence, the quality of her writing, career aspirations, as well as increased her willingness to work with and support others (classmates, neighbors, and family members). Rachael was a rather belligerent computer user at the beginning of the year; at the end of the year she was invited to attend Applefest as an advocate and computer expert.

- The ACOT experience afforded opportunities to collaborate with others and this contributed to students developing the ability to self-monitor the quality of their ideas as their thinking was transformed into written text. The transformation of ideas to the electronic media made a contribution which should not be overlooked For example, several students commented that the movement from handwritten discourse to computer-generated text allowed them to more readily review their ideas, check their coherence, and so on. Furthermore, many noted that with the assistance of technology, changes or alternatives can be more easily pursued.

- The ACOT environment has changed between year one and year two.

  — In year two, compared with year one, students seemed to be given more opportunities to work together on projects and pursue their own collaborations.

  — Networking capabilities were expanded.

  — As software capabilities expanded gaps between experts and novices widened and students specialization increased.

The Influence of Hypercard Upon ACOT Students' Thought Processes and Perspectives During Reading, Writing, and Learning

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Introduction

The Apple Classroom of Tomorrow represents an ideal site for research and development as educators explore the potential of computers including the influence of new technologies upon learning and communication. Over the past year Hypercard has been heralded as a major breakthrough for computer users in terms of the possibilities it affords everyday uses in terms of information access and modes of communication. The multimedia, multi-layered text capabilities afforded by Hypercard appear to have the potential to add a new dimension to students' ideas of "writing" and the nature of written texts. This new technology affords computer uses new possibilities as readers and writers: 1) it gives writers the opportunity to incorporate multiple medias in one text, 2) it gives readers different routes to follow as he reads the text, 3) it allows learners to criss-cross topics in various ways including different layers. The new software, Hypercard, allows computer users to compose "texts" that include animation, graphics and can connect the computer with a video disk player that can play specially selected segments of color video. The reader of these texts can select the route that he takes through the text because he can move through the "text" in a nonsequential order. The author of the "text" provides optional routes that the reader can take. The texts also have multiple layers of information. The author provides specific places in the texts where the reader can request additional information. The text then displays information not previously visible to the reader. Hypercard allows the author to decide what media they will use to represent what information. It provides opportunities for the reader to move between the different media incorporated into the texts.

The possibility of multi-media texts seems to have already impacted students in the ACOT classroom. In particular, ACOT students introduced to Hypercard are

seeing the computer not only for its computational abilities but also for its representational abilities. These representational abilities are changing the student's conceptions of what a text is from a rather static view to a more dynamic one. In accordance with a rather static view, students tend to adopt a rather passive approach to text processing. They tend to assume an approach to text processing involving linear rather than recursive negotiations. A more dynamic view engages students to consider a variety of possible routes and shifts in direction.

For the educator, Hypercard raises several very important questions regarding the extent to which Hypercard might enhance learning and change communication. For example, answers to the following questions might be posed. In what ways do reading, writing and learning differ with this new technology? In particular, do students engage a different array of thought processes when developing multi-media, multi-layered texts? Do students' views of the texts that they are developing differ? Do students establish different goals for themselves as readers, writers, and learners?

Methodology

A decision was made to pursue a preliminary probe of the use of Hypercard in conjunction with its introduction to the ACOT students toward the end of the year. As part of their biology class in the ACOT classroom, the tenth graders developed a study guide based on their biology book using the Hypercard software. Pairs of tenth graders chose a chapter from the biology text and developed the study guide from the content in the text, but using the capabilities of the Hypercard software. During the general debriefing interviews the tenth graders were asked about their experiences as authors and readers of these Hypercard projects. Four ninth graders were also asked to compare reading/studying the biology textbook with the Hypercard stack. They were asked in interviews how they would proceed to study each and observed studying both.

The interview that was conducted with the students had three parts. In the first part of the interview the students were asked how they would study the biology

chapter and then the Hypercard project for a test. This was followed with observations of their behavior as they studied the same information presented on Hypercard and a biology text. In the second part of the interview students were asked what they thought were the advantages and disadvantages of the biology and Hypercard project. We were hoping that by asking them to compare both kinds of texts that we would have an opportunity to find out what their notions of text were. In the third part of the interview students were asked to compare composing or writing a Hypercard project with writing a written assignment. In this part of the interview we were looking for what the students had to say as authors. We also asked specifically if they thought their idea of what a text is had changed as a result of their experience with Hypercard.

Coded comments

On the following pages the comments of selected students are charted as a means of affording an examination of the data and presenting our methods of coding.

If you examine the charts you will notice that the students' comments were organized into overall areas (reading, writing, and comments pertaining to disadvantage and advantages) and then these comments organized further to afford a comparison of Hypercard with "regular" text. Comments were then labelled as pertaining to text, reader and author and whether or not they were pertaining to interest, format (buttons, bold face, animation, etc.) or accessibility issues.

MUM - COMPOSING COMPARISON

T1=Text Format	**R1=Reader Format**	**A1=Author Format**
T2=Text Access	**R2=Reader Access**	**A2=Author Access**
T3=Text Interest	**R3=Reader Interest**	**A3=Author Interest**

Hypercard		Writing a Regular Paper	
A2	...real easy to work with...when you get the background that you need	T1	But writing paper, you have no interesting little objects (buttons, pop-up fields) to put in.
A2	...you just delete the part. If you want to make a report you have those pictures and those little text fields.	A2	It takes time, you have to erase, copy over
A2	I think the idea of writing stays the same. It's just how you use the piece of writing that you have.		
A2 R2	The info is the same all that changes is how you present your writing, how you show people what you worte.		
R3	...it catch the attention of the reader. You look at it and you want to read it.	T3	But like in paper and pencil you just look at it and say, 'Oh it's just another piece of writing', you know.
T3	But Hypercard really makes your subject interesting.		

Findings

There appear to be several dimensions to the effects of the Hypercard experience.

- Hypercard-based texts prompted the students who developed them to be more sensitive to the license a reader might assume. As authors of multi-layered, multi-media texts (which offer readers different routes for purposes of exploring a range of ideas), the student authors were more aware of the readers prerogative—license to choose from different options based upon somewhat idiosyncratic needs and interests.

- Hypercard-based texts prompted the students who developed these texts to expand their view of the functions such texts might serve. They seemed less to a simple reporting of ideas and more aware of their reader as a learner with an array of needs. As David stated,

> You learn more...because you have to teach it to other people. You have to present it in a way that's understandable to them. ...You can't just get away with knowing it, you have to understand it so you can put it in your own words and use your own methods of showing it to people.

- In conjunction with the multi-media possibilities of Hypercard, the development of Hypercard-based texts supported a more careful grafting of visual representations (e.g., animation, video) to complement, extend, and undergird the written explication of information. In conjunction with formatting options and the multi-layered possibilities afforded by Hypercard, the development of Hypercard-based texts prompted developers to consider more fully the relationship between function and format (especially the multi-layering of ideas for purposes of explanation).

- Hypercard-based texts prompted the students who read these texts to adopt responsibilities and take licenses that they tended not to assume with regular text. With regular text they tend to adopt a regimented approach tied to locating and organizing factual content. With Hypercard-based text they are inclined to go beyond their regimented concern for facts and explore ideas and issues with which they are interested.

> It's made me look at learning about different things in different ways, it's made it more interesting, it's made me a little more creative than I might have been because I'm seeing all these different things and I can learn more from them because there's just so many different ways of showing them and I can expand on what they're showing

me and go off in my own directions which I think is easier to do that with different technologies than just with a 'text.'

- Strategies for learning appeared less linear and more recursive with students studying Hypercard-based texts. When students studied from a regular textbook the majority had a tendency to proceed in a linear fashion. Students using Hypercard were apt to pause to either consider alternative explanations, etc. as they sought explication, pursued other interests or cross-checked emerging understandings.

- Hypercard prompted students to refer to the visual representation of phenomena to clarify, to enlarge or to check understandings. With "regular" textbooks diagrams and other graphics made less contribution to readers' developing understandings.

- Hypercard appeared to prompt readers to develop self-initiated purposes. When reading the "regular textbook" students pursued factual content they assume the teacher is emphasizing; when pursuing a topic with Hypercard students initiated purposes which extended beyond their perceptions of the teacher's objectives. In particular, they initiated purposes which were related to extending, evaluating and tying together ideas.

- Hypercard appeared to make ideas more accessible. As Mum stated,

> With Hypercard you don't have to read as much and what you read you take in fast.
>
> ...and this said 'click on the boldface to see more about them', I would try that. It shows a definition, I would go through the words so that I would know more about them.

Or as Rachael explained,

> It's a lot easier, because you know if you want to know what it is and if you don't know you can click on (the bold face) and there it is.

> You can understand it better, if you don't understand what this is or something or don't understand what it's doing or something, look up here (on the video screen) and you can understand it better. Or it could be the other way around.

- Hypercard has enormous motivational qualities that the regular textbook did not have. The students said they were more motivated to study, they were "more into the material." Jason stated,

  > It's more interesting because you get to see pictures, and the entire screen. You get to move around more than just sitting back with the textbook.

  Toya said,

  > Yes, it's easy and it's fun too.
  >
  > ...because when you make things fun people want to learn about it. And when it's just in a little book or something they just say, 'Oh, this is boring.'

- For writers, Hypercard may allow for overly stylized development of text which encourages a consideration of form which displaces a consideration of content. Hypercard encourages authors to use a graphic in more subtle ways. For readers Hypercard might allow for overly idiosyncratic explorations of a narrow band of ideas.

Some closing remarks

It should reemphasize that the present probe is preliminary. It suffers from several shortcomings including: 1) the scope of the questions which were pursued, 2) the methods enlisted to answer the questions that were asked, 3) the subjects limited exposure, yet interest in the novelty of Hypercard.

Despite these limitations it should be noted that:

1. The present findings correspond with those emerging from other studies involving similar technologies. For example, in a study by Levenson, Morrow & Signer, comparing four groups (interactive video, viewing video individually, viewing video as a class and control) found results favoring interactive video. The parallels between the findings of this study with our own are noteworthy. They found students in the interactive video condition group were more interested in knowing, more self-initiating, and felt as if they had greater control over their own learning.

2. The current set findings suggest a number of important issues for further and more extended research. Further study of the effects on the students view and approach to text is essential. The basic questions which should be pursued further is: Does Hypercard prompt readers and writers to adopt a different view of text and how text functions? Do understanding and routes to understanding shift with Hypercard?

Overall Findings

Overall Findings

In ACOT, computer use has been integrally woven into the fabric of classroom life and student learning. The discussion of overall findings that follows provides a glimpse of what has been achieved in this setting. It should be noted that many of the outcomes which ACOT has realized are not altogether different from what is achieved in a traditional noncomputer-based setting. What sets the ACOT apart, is the precise nature of these outcomes and the extent to which the outcomes appear to exceed what might normally be expected.

What has been observed in ACOT in terms of engagement and enhancement of students' thinking processes:

- Consistent with the findings for year one, ACOT students had a sense of purpose, including the pursuit of excellence, and an understanding of the relevance of classroom learning on the outside world. They viewed themselves "on the cutting edge" of computer learning and use.

- The ACOT students in both ninth and tenth grade commented that they felt very positive about what they have been exposed to, what they learned and what they were able to do in ACOT. Above all, they have an enormous amount of confidence in themselves. The students have developed skill with the computer and use it more readily than paper and pencil. The software with which they have had experience has afforded: 1) opportunities to problem-solve using computer-based simulation; 2) support for the visual representation of ideas and the integration of visuals with written representations, and 3) the development of word processing capabilities which

support the refinement and restructuring of ideas. From a broader perspective, the computer-based experiences and skills acquired extend beyond the ACOT classroom. In particular, students used skills outside of ACOT in conjunction with work in the "regular" high school, as well as for purposes of personal projects outside of school.

- In year one, the students did not claim that they learned differently with the computer, but that it was more challenging. In year two, several students commented that Hypercard, computer-based robotics and graphic possibilities afforded a more dynamic learning experience.

- The graphic options available with the Macintosh appeared to be a vital feature of their writing and the nature of engaged thinking strategies. Graphics appeared to supplement both the development and presentation of ideas. For example, the graphic capabilities of the Macintosh guided rhetorical discussions, as well as provided students scaffolding for the exploration and development of ideas. Apart form visibly fueling the development of written texts, the potential for graphics with the Macintosh also served to enhance visualization and imaging. Oftentimes, ideas appeared to be encoded by students as visual images with aesthetic qualities not readily captured in words.

- The possibility of multi-media, multi-layered texts (with Hypercard) appears to have impacted ACOT students. Hypercard prompted developers of Hypercard stacks to: 1) be more sensitive to the license a reader might assume; 2) to be more aware of various functions text might serve, and 3) to be more careful about grafting visual representation with written text. Hypercard texts prompted the students who read these texts to adopt responsibilities and take licenses that they tended not to assume with

regular text. With regular text they tended to adopt a regimented approach to the text and focus on locating and organizing factual content. With Hypercard stacks, they adopted a more recursive approach—pausing to consider explanations, self initiated purposes, cross-check understandings and to clarify or enlarge thinking through visuals. In all, the representational features of Hypercard seemed to move students from a more passive role to a more active one and to engage a wider variety of representational abilities.

- Over the course of the year, both the ninth grade and tenth grade students demonstrated an expanding repertoire of planning and revision behaviors. At the beginning of the year the students tended to restrict their planning to a consideration of genre and what they knew about the topic based upon teacher input. By the end of the year, the planning by students was more expansive. It involved being more sensitive to audience, purpose and integrating graphics as well as the inclusion of a wider array of ideas. Simple listings of ideas gave way to more complex mental representations which were revised substantially as text development proceeded.

- The transformation of ideas onto the electronic media made a contribution which should not be overlooked. Several students commented that the movement from handwritten discourse to computer generated text allowed them to more readily review their ideas, to check their coherence, to be more sensitive to flaws, to develop confidence as a writer and to contribute to their willingness to share with others.

- All of the students progressed markedly from the beginning of the year. Several ninth graders were hesitant—almost

recalcitrant—computer users at the beginning of the year; at the end of the year all of them were fluent computer users. Each of the tenth graders expanded their repertoire of skills, confidence, as well as ambitions. Most notable were Lisa and Mark who experienced a great deal of success and increase in confidence as writers.

- ACOT students who return to the 'regular' school maintain some of the computer-based skills that they acquired—especially word processing. Unfortunately, each student commented on the lack of opportunity and sometimes discouragement to enlist these skills within the regular school situation. This predicament seemed heightened due to problems of computer access and the nature of the curriculum.